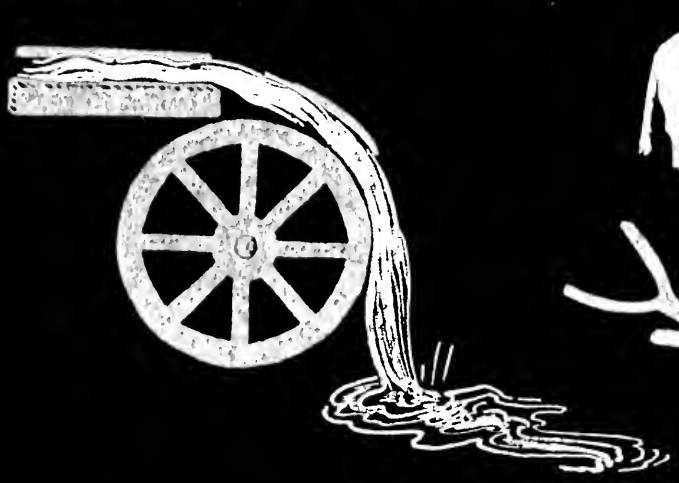
# Man's Venture in Culture

by

Thorne Deuel



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STORY OF ILLINOIS SERIES, NO. 6

# MAN'S VENTURE IN CULTURE

## SOME INVENTIONS UNDERLYING CIVILIZATION IN ILLINOIS OF TODAY

by

THORNE DEUEL

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## FOR FURTHER READING

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# INTRODUCTION

For some years it has been in my mind to write an account of man's ventures into the seemingly unlimited lanes and byways of his manner of life from the time when he was an animal without culture or society to that state occupied if not altogether enjoyed by some groups today, which we call civilization—and to accomplish this in a short space and in language easily understood by the non-specialist. The attempt to do this appears in the pages that follow.

Being involved in directing a museum with little leisure to read, I had arrived at a system that seemed to me to simplify the cultural picture and to explain the evolution of culture reasonably even though it seems at present impossible to demonstrate scientifically. On submitting my earlier manuscript to friends, my attention was promptly called to the writings of Childe, Linton, and White. These I subsequently read but found no reason to change the main outlines of my system though details were changed or added after due consideration on account of these readings or suggestions from others. Consequently those who would ordinarily be considered as sources (being earlier in print) should be absolved of any shortcomings of which I may be guilty.*

Doubtless much that is said below has been said before and most statements made are held by one group or another of living anthropologists. Possible exceptions may be the key inventions, their manner of combining with the possibilities of man's physical make-up and the existing frame work of culture, and the cultural stages resulting from the adoption of the basic devices. Whether or not the proposed system is "right" as against any or all the others proposed does not seem important since it is far more significant that thought and research may be stimulated so that we may be better able to comprehend the nature of the ways of life in general, their manner of changing or evolving in the larger sense, and how from the vast amount of detail in anthropology and history those factors may be chosen that are truly significant in a dynamic cultural way.

Footnotes have been placed at the back but it is advised that they be disregarded on a first reading of the paper. The list of books given are for those who wish to do further reading. They are not sources. To have listed all the sources used for illustrative material or in the construction of the dioramas would have taken far too much space.

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* The reader is urged to read the publications listed below if he is inclined to follow up the subject.

(1) V. Gordon Childe: *Man makes himself*—London 1948.

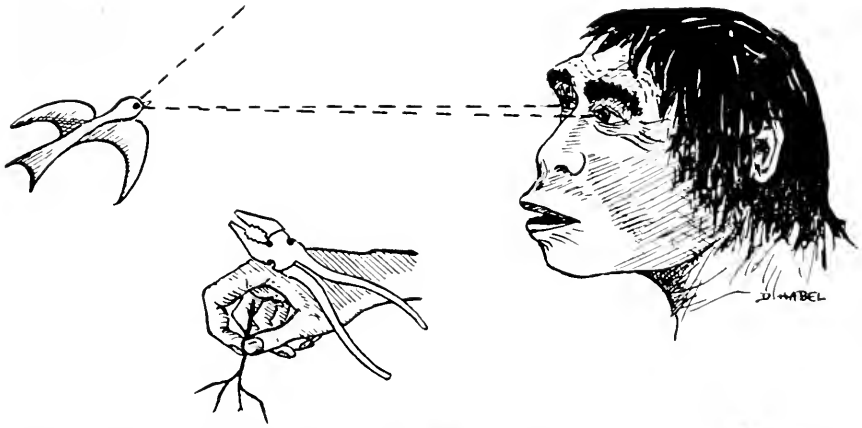
(2) Ralph Linton: "Present World Conditions in Cultural Perspective" in *Science of Man in the World Crisis*, pp. 212-218. New York 1945.

(3) Leslie A. White: *The Science of Culture*. New York 1949.

My appreciation is due my good friends Robert Braidwood of the University of Chicago and Georg Neumann of Indiana University who read the manuscript, discussed sections of it with me and made valuable suggestions; to Frances S. Ridgely for the cover design; to Dorothy Habel and Howard Knotts for the preparation of the drawings and Charles Hodge for his excellent photographs.

THORNE DEUEL

*Springfield, Illinois*
*25 March 1950*




# MAN'S VENTURE IN CULTURE

## I.

## THE KEY INVENTIONS

Man has in the million or more years of his existence made three major inventions,—key discoveries each of which unlocked a series of other discoveries and inventions that have resulted in our complex cultural heritage of today.

It is very possible that the basic inventions took place at times of crisis or great stress, that several individuals of relatively high intelligence for the period existed, that the desire to live was at a high pitch, that the material for experimentation was at hand, and the cultural background, however scanty, had reached a comparatively high level so the next step was an "easy" one. The eventual results of taking each step seem out of all proportion to the simplicity of the key invention itself. Doubtless the period following the adoption of the new invention was a time of great activity and experimentation, of unrest, uncertainty, and marked by the movement of human individuals and groups.

The three great inventions were (1) the invention of a chipped stone weapon-tool of simple though specialized type that became a persistent traditional form; (2) the domestication of plants and food-draft animals;[1] and (3) the development of inanimate-power machinery. On careful examination these inventions are seen to be complex and to consist of one or more discoveries plus new formulas or patterns of human activity, not the mere combining of cultural elements already in existence. The invention may be hundreds or even thousands of years in reaching a point of great serviceability to man and the cultural and social change made possible may lag for another long period.

These primary inventions divide man's existence into four periods or stages:[2] (1) the brute or feral period lasting roughly from 1,000,000 to 500,000 years ago; (2) the period of self-domestication from 500,000 years ago to about 8000 B.C.; (3) the age of food production or farming from 8000 B.C. to 100 B.C.; (4) and the period of inanimate-power machinery after 100 B.C.[3] This period we now live in.

[1] For footnotes see Notes, pp. 37-40.

## 1. *Man or Ape?*

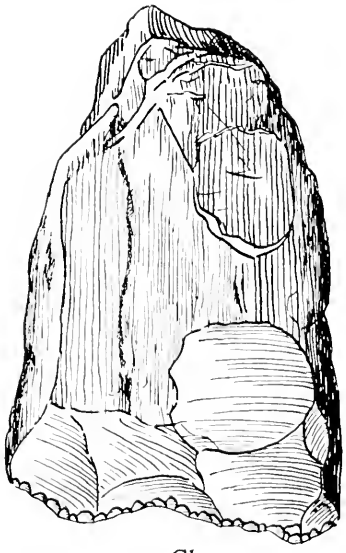
Somewhere, possibly in south central or western Asia, or perhaps it was in Africa, a million years ago or thereabouts, man (or perhaps we should say the ancestor whose children's children were to be men) made his appearance on earth; that is, he took the first steps in activities and in a physical and mental direction that started him along a path that branched off widely from that followed by his cousins, the great apes. Nevertheless, for many hundreds of thousands of years after that unconsciously momentous "decision", he must still have been a simple, ape-like creature who had to scrabble for his food, picking berries, fruits and nuts, digging with his hands for edible roots and tubers, catching insects, lizards, fish and small mammals, and climbing trees for birds' eggs. His hairy skin formed his only clothing and trees were his refuge from enemies. What a contrast to the bustling ordered life of man today!

Like the apes, this apeman had an opposed thumb,—that is, the thumb was set apart so he could place it against the end of the other fingers to form pincers and to grasp objects. While on the ground he often stood on his hind legs, thus freeing his fore limbs and hands to do many things that animals using all four legs for walking could not do. Thus he could seize food and carry it to his mouth, or pull himself up into a tree. The fact that his eyes were in his face instead of on the sides of his head, as in most mammals, was another advantage. He looked forward or in whatever direction he faced and both eyes could be directed or focused on the same spot or thing. As seen from the menu given above, he was not choosy about his food but ate many kinds. This made it easier for him to get a meal than if he had liked one kind of food only. Above all, he had a persistent, cautious curiosity that caused him to investigate or pry into things without often getting him into serious difficulty.

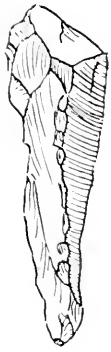
Hundreds of thousands of years rolled by. In appearance the apeman still looked much the same; his ways, too, had changed but little. He still scrambled for his food in the same old ways though now and again he armed himself with sticks and stones to bring down small animals, to dig up roots, to ward off the larger mammals and to settle disputed points in arguments with neighbors. In his leisure moments he may have selected naturally sharp or edged rock fragments for such purposes. Occasionally he may have cracked stones hoping chance would give him an implement better fitted to his needs. Some of these implements, known to archaeologists as *eoliths*, varied from each other so much that it is impossible for most of us to see, among the vast number found, any persistent type.

He still chattered to his mate during the mating season or to his growing young, but he could not talk as man does everywhere today. He probably built nests or crude platforms in trees for resting places and for his family when the young were helpless. He may even have used fire for warmth though he may not have known how to produce it. All in all, however, he was a creature without culture, a non-social brute who knew none of the arts and crafts that savage or more advanced peoples have learned.

Then "one day" something happened, the effects of which will stop only when man himself ceases to exist.



Chopper



Clactonian Flake

Hand Axe (After Braidwood)

## 2. *Man Tames Himself*[4]

Sometimes in the ancient past, probably between 500,000 and 300,000 years ago, a hairy, chinless genius hit upon a fascinating and useful discovery. It gave him the edge over all his enemies and acquaintances. Probably ape-men had been cracking stones haphazardly for tens of thousands of years when it dawned upon one of them that when he struck one kind of rock (flint) in a certain way with a cobblestone, he always got the same result,—the removal of a flake leaving a shell-shaped (conchoidal) hollow or scar on the rock mass. Perhaps it took him sometime to understand that by removing several flakes in turn he could make himself a very good *chopper* or *fist axe*. More likely it took many men many years to "complete" the invention of a weapon type after the discovery of a flaking method, for this was a far different kind of thinking-acting than any animal had ever done before. Imagine his sense of achievement on finishing his first crude implement, his feeling of self-assurance and power! He now had the advantage over human enemies that had not the new invention and in time would be more than a match for the great mammals that preyed upon him.

The invention seems to have resulted in finally bringing man out of the trees and down to earth.[5] He could now cut branches and build for himself on the ground windbreaks resembling his former nests in the trees. By trickery and the force of his new weapon he could win caves from the cave bear and the cave lion.[6] By closing the entrance he could keep them from returning. The cave was a safe place for rearing the helpless young. The woman could defend it against intruders while the man hunted. Besides taking care of the children the woman collected edible plants, prepared the food and, when it became necessary to protect the family from winter cold, she made clothes from skins. For

the first time man had a relatively fixed home and probably for the first time, too, the family consisted of children, parents, and other close relatives. Man had domesticated or tamed himself.

Doubtless early in the period language developed from mere animal cries into the stage of symbols. As the desire grew to distinguish between objects and to convey to others information or ideas about different things or happenings, man must have struggled long and valiantly against the seeming ineptness of his tongue and other vocal organs, to explain why he brought home no game or to tell how big the fish was that got away. Largely due to these attempts the tongue became more flexible, the other vocal organs were modified and changed gradually to the conditions favorable for speech as present in human beings today. It is entirely possible that before the beginning of the next period, the spoken language had become complex and had all the potentialities necessary for the development of modern speech. The need for *writing* thoughts down was still thousands of years away.

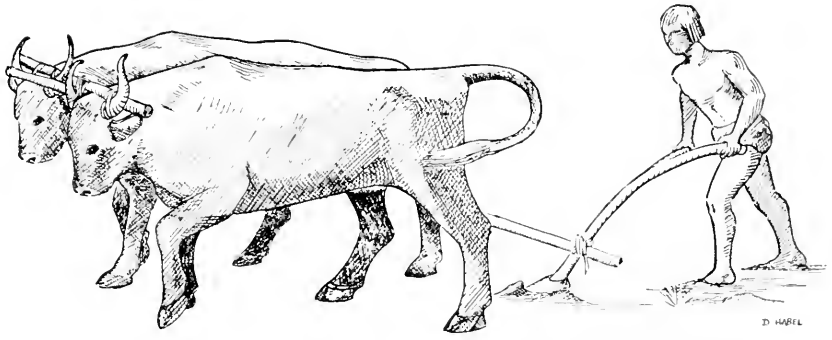
With the increasing activities of hands and speech organs, man's brain, especially the frontal region, increased in size. This was due in a large measure to the coordination required between hand and eye in the making of tools, and to the development of speech. At the end of the period mankind, essentially as he is today in physical make-up, had appeared.

## 3. The Food Production or Farming Stage

After tens, perhaps hundreds of thousands of years of gathering seeds for food during the self-domestication period, another great observer, this time probably a woman, noticed one day that some of the plants, the seeds of which she collected for food, now grew about the mouth of the cave. She may have been aware that the plants had sprung from the seeds from an over-turned basket of the past season. At any rate it came to her that she could scatter seeds near the cave or windbreak and gather the grain when it became ripe, right at her doorstep. So gardening or hoe-culture, as anthropologists call it, began in Asia. Breaking the ground and preparing it for sowing, the removal of useless plants or weeds to increase the yield of grain were improvements that would come later.

Among the mammals hunted by man were the huge urus or wild cattle that grazed the grasslands in great herds. Probably more than one hunter over the hundreds of years past had brought back a calf from the hunt to raise as a pet in the cave with his children.[7] One of these hunters reasoned that he could raise many calves, create a herd, and have his own private meat supply right at home. So the hunter became a herdsman and later learned to *count* his cattle as a measure of his wealth and importance.

Since he no longer needed two to four hundred square miles of land for hunting to insure enough food for his family, farmers could live closer together than hunters. As we shall see later, the farmer had to stay at home, and he could afford to spend more time and effort in building his hut, a new invention. Dwellings were placed near each other so neighbors could get together in a hurry to beat off raiding



parties that might try to drive off their cattle or rob them of their grain. In other words man now had property to protect.

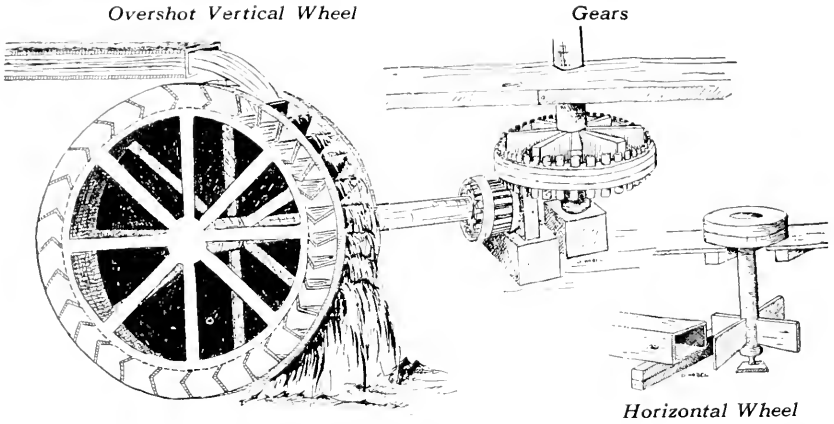
To the hunter, *property* had little or no meaning. If the storm destroyed his windbreak, or rain spoiled his food, what matter? The raw material was his for the taking and he could readily replace his losses. Now all this was changed. There were flocks, herds, houses, grain, not to mention household goods, cooking and storage pots. These took time, care, and labor to make or accumulate; their loss would be a real hardship or might even spell starvation. Thus the idea of private property grew up early in the Food Production Stage. The farmer or some of the family now had to stay at home, a truly fixed home, to work in the field, tend the sheep, and protect the family property from thieves or borrowers.

When the first farmers decided to live next door to each other, polities and society were in the making,—a new social unit, the village, was created. Families now had to learn to live peaceably, both as individuals and as groups, with other families. Customs grew up as to what was right conduct and what wrong, and as to what should be done by different persons when another was injured by a fellow villager or by an outsider. These customs came in time to have the force of law (as we know it). This was long before man invented writing systems so these laws could be written down as Hammurabi did in Babylon.

Another advance in food production took place when a farmer had the amazing idea that he could hitch his ox by leather thongs to the digging stick used by the women in gardening. Man now (3300 B.C.) had the plow. Women of the household still tended the gardens but where animals were employed in breaking the soil, the men now generally took over the work.

Elsewhere in the field of tools, weapons, and instruments, man did not stand still over the centuries. At the beginning of the Food Production Stage, man was using chipped and polished stone tools; before it ended, he was making them out of iron and other metals. He invented the wheel and the cart. He made machines and powered them with his draft animals. By 2200 or 2000 B.C., he had tamed the horse and was hitching it to the cart and chariot, and somewhat later was riding on its back.

As the centuries rolled by, new inventions and improvements in old methods became too numerous to be even mentioned here. Complex




social, political, and commercial enterprises and groups sprang up. Villages grew into cities, cities became rich and powerful through the strength of their armies, conquered weaker rivals, or banded together to form kingdoms. Egypt lasted as a nation for over three thousand years but usually kingdoms disappeared after a few centuries and others took their places. Rome, one of the greatest empires of the ancient world was founded (according to tradition) as a kingdom, changed to a republic, to an empire, and after lasting nearly a thousand years altogether, finally fell apart in the fifth century of the Christian Era (476 A.D.)

## 4. *The Age of Inanimate Power Machines*

As suggested before, the key inventions were probably the work of many people, and much time elapsed before they were completed and began to affect man's life greatly. The inanimate power machine is a good example of this. Nearly three thousand years passed after man learned that a stream of water could be used to turn a wheel and lift water to the level of his fields before the invention really took hold and commenced to change vitally his manner of life,—and then among a people who didn't invent the original machines.

The Chinese are said to have used a primitive waterwheel (or noria) as early as 1000 B.C. to lift water for irrigating land. This was a vertical type of *undershot* wheel (so-called because the water strikes the bottom of the wheel instead of the top as in the *overshot*).

The earliest known record of inanimate power being used to run a machine is given by the Greek writer, Strabo. He relates that Mithridates VI (King of Pontus, Asia Minor) had in 88 B.C. a grist mill (for grinding grain) that was turned by a waterwheel. So for this invention, too, it seems we are indebted to Asia. The waterwheels we have been talking about are vertical ones and turn around a horizontal axle or shaft. Since the grinding surface of the millstones had to be horizontal or level to keep the grain from falling off before grinding was complete, a device was necessary to connect the horizontal axle of the waterwheel to the vertical shaft about which the millstones turned. This was accom-

plished by the invention of the *pin and trundle* gears, the ancestor of the modern bevel and spur gears.[9]

This early form of cogwheel may be seen at the reconstructed village of Lincoln's New Salem (twenty three miles northwest of Springfield) where the Rutledge-Cameron saw-and-grist mill and the carding mill have been restored on their former sites. If you visit the village which is maintained as a State Memorial, and are lucky, you may see one of these mills running.

The horizontal waterwheel was developed early (possibly before the Christian Era) in southeast Asia. This wheel having a vertical shaft needed no cogwheels but was attached directly to the millstones. It was the forerunner of the water turbine, a more efficient engine than the more familiar (vertical) waterwheel.

The water mill spread over much of the Roman empire in the first centuries of this era. In addition to grinding grain, water mills were employed for cutting stone and sawing wood. In England, the monks of Kirkstall Abbey in Yorkshire were using an undershot (vertical) wheel in 1152 to grind grain. This was probably not the earliest in England since water mills were spread widely over continental Europe by the 8th century. Nevertheless significant new delevelopments in inanimate machines did not appear for more than nine hundred years later.

In England many new machines for making textiles or cloth were invented between 1733 and 1790 and were powered by the water wheel. Before this time, most industries were carried on in the home by members of the family, who at the same time also farmed sufficiently to furnish the daily food. After 1800, the industries shifted from the home to the factory because of the speed and cheapness with which cloth and other goods could be made by machines and on account of the lure of wages (desire to receive money rather than make articles for use and get the mere satisfaction of completed work). This caused large numbers of people to leave the country or rural sections and settle near the factories which were built in cities or around which cities soon grew up.[10]

Changes in man's way of life now followed one another rapidly. The farmers who produced food and raw materials became a group distinct from the factory workers who manufactured flour, cloth and steel; and their needs also differed. Expensive machinery, the cost of operating mills, and paying large numbers of workers and other factors divided capital (those who owned the factories) from labor (factory workers). The crowding of large numbers of people into the factory districts brought health and other living conditions to low levels and increased many times the difficulties of police, fire and safety supervision, and the problem of maintaining democratic ideals of government. The greed for profit and wages overshadowed the aim for use and service; the need for raw materials and for markets where the finished goods could be sold gave rise to imperial policies in the industrial nations. Civilized nations subdued less advanced peoples who lived in the areas where raw materials could be obtained cheaply and who could be repaid in part in finished goods thereby still further increasing profits. These undeveloped countries provided opportunities for investment for wealthy producers at high rates of return. The whole world became in a short century linked in a network of economic interdependence.

No family could now raise or produce all the necessities of life that it consumed as food, clothing and building materials but generally depended on its members having jobs to provide wages from which to buy these goods from various sources in their own and foreign countries. Extreme poverty of the many and great wealth of the few, failure of political leaders and governmental agencies to solve these wide differences, and many other problems arose from the rapidity of production and the difficulties of adequate distribution of goods. The doubling of the world's population between 1800 and 1900 increased these problems immensely. Continued growth of population, the struggle for food and other necessities, and national rivalries in industrial ambitions have resulted twice in world wars and brought to many of the earth's peoples a hope that toleration and reasoned international cooperation may outlaw war and bring about an economy of sufficiency for all.

## II.

## SOME INVENTIONS UNDERLYING CIVILIZATION IN ILLINOIS OF TODAY

The illustrations in the pages that follow are from photographs of the Diorama Series now exhibited in the Illinois State Museum, entitled *Man's Venture in Culture*. The series was begun by H. Brainerd Wright (now of the Louisiana Department of Agriculture) and completed by Bartlett M. Frost (now of the Detroit Historical Museum), while Dioramists at the Illinois State Museum.

The Wright-Frost Dioramas show scenes of some of man's noteworthy achievements as he developed from a dumb animal to civilized man of today. The only scene exhibiting man in the wild or feral stage is, possibly, that of the Java Ape-Man who is shown on the threshold of the self-domestication stage.

Beginning with Peking Man (Scene 2) and continuing through the Ertebölle (Scene 5) on the shores of the Baltic Sea, man is definitely in this second stage.

The Swiss Lake Dwellers are well along in the third or farming period where they *produce* their food by raising plants and animals. This stage nears its end with the physician in the courtyard of a 5th century Greek home. With the scene at the Roman aqueduct, we find ourselves at the beginning of the fourth or industrial stage which continues to the end of the diorama series.

## *1. The Dawn of Culture*

Along the banks of what is now known as the Solo River near Trinil in the Island of Java, a half a million years ago, lived and roamed the Java Ape-Man, or as scientists call him, *Pithecanthropus erectus.* We know about him because some of his bones were found in the river deposits laid down in the middle Pleistocene geological period.

Java man had a low forehead that sloped sharply back from his beetling eyebrows while his chinless jaws and lower face were prognathous or thrust forward, giving him a savage, beast-like appearance. His body was powerful; in height he was about the average of modern man, and he stood erect as his name implies. He was probably covered with body hair like other mammals. His brain, however, was much larger than any of the known apes and was apparently higher developed mentally. From his outward appearance when reconstructed, scientists at first thought him to be as much ape as man, as his name indicates.

No artifacts (implements made by man) were found close enough to his bones to be certain, but it is generally held that he knew how to make stone tools and the use of fire. Whether the tools were haphazard *eoliths* or *choppers* is unknown. It is probable that he could not move his tongue about as freely as we do and that he was without speech as we know it.

## 2. *Early Cave Dwellers of China*

Far to the north of Java near present day Pekin in China, hundreds of thousands of years ago (375,000 B.C.?) lived another ancient man, a cave dweller, that closely resembled the Java Ape-Man. He is called *Sinanthropus pekinensis* but on account of his apparent near relationship to Java man, many scientists think he should be named *Pithecanthropus pekinensis*. Let us call him Pekin Man. What we know of him was revealed through the discovery in Choukoutien Cave of several skulls and a few other bones.

A careful study of the skulls and long bones (principal bones of arms and legs) showed that he ate human flesh. A hole was knocked in the side of each skull to remove the brain and the long bones were split lengthwise to make easy the removal of the marrow. In times still ancient, earth had been washed down over the remains of his feasts, and filled the cave. Later this earth hardened into rock and preserved within it the human and other animal bones until they were discovered early in this century.

Stone tools found in the cave were of the core type (chopper) and probably belonged to Pekin Man. He is thought to have known the use of fire and possibly how to make it.

Professor Weidenreich, who made an exhaustive study of the skeletal remains, believed him to be the direct ancestor of the modern Chinese; most anthropologists disagree with him. For a final answer we must await more evidence.

## 3. A New Invention

In developing stone tools of specialized type, man seems at first to have utilized the core (main mass of the rock or flint fragment) primarily and universally.[11] The earliest tools from western Europe are of the core type and are called *hand-axes* (though they have a point rather than an edge at the striking end) while those from eastern and southeastern Asia are adze-shaped and are known as *choppers*. Hand-axes occur as a dominant tool over most of Europe, Africa, and western Asia, including India.

Doubtless man found out early in the weapon-tool making stage that the chips or flakes he removed in shaping the usual tool were sharp and useful for certain of his needs without any further flaking. Probably at an early date, too, man realized that some forms of flakes, especially suitable for finer kinds of work, could, by a slight modification, do these tasks even better. In western Europe locations are found where groups using only core type tools lived, and near at hand there are other sites the dwellers of which employed flakes alone.

The Abbevillian phase was a way of life in western Europe where tools were made only from the core; the chips or flakes were thrown away without being chipped for further use. It is easily imaginable that the young Neanderthal of the Abbevillian phase[12] would be elated to discover that a flake which he usually threw away could be adapted to dig out a fine groove or to scrape a club handle smooth. The heavy hand-axe was useless for such a task. It is equally understandable that the father, older and of long experience, should look with disgust upon the new-fangled gadget. "No, son, leave silly toys to simpletons. You have been taught the good ways to make a man's weapons." Nevertheless, later Neanderthals made tools from flakes and the idea spread over the whole Eurafrasian world of using both core and flake implements early in the self-domestication stage.

## 4. *Hunters and Artists*

We have seen how ape-like the Java and Pekin Men were. With Neanderthal Man we get a change in physical type. The Neanderthal's brain was larger than that of ancient man, his features less ape-like and his tongue was free from some of the earlier hindering conditions of the lower jaw.[13]

During the latter part of Neanderthal's domination of southern Europe and western Asia, a new type of man appeared in France known as Cro-Magnon. Whether or not Cro-Magnon developed out of Neanderthal is still doubtful. The evidence is far from clear or complete. Although Neanderthal skeletons are most numerous of the older human types in Eurasia, anthropologists are loath to admit him as a candidate for the ancestry of modern man in that region. Cro-Magnon on the other hand is generally accepted as an ancestor of white Europeans.

In an early cultural phase Cro-Magnon hunted with spears and javelins and organized great cooperative hunts in which he drove large herds of horses or other animals over cliffs to provide his family with meat for food, and hides, bones, fats and other animal parts for clothing, tools, ornaments, and other needs.

In Cro-Magnon's last or Magdalenian phase the large stone javelins and spearheads no longer appear and smaller less carefully made flints are plentiful. Cro-Magnon man (and his close cousins, Brunn and Combe-Capelle men) had, for differing climatic conditions, a number of ways of life as shown by their different tool-kits found in various parts of Europe. Most of the stone tools of these kits consisted chiefly of implements and tool parts made by a new preparation habit,—the blade tradition.[14]

How did this man hunt? Not with bows and arrows, but with bone and ivory-pointed harpoons hurled by a thrower or atlatl. This period is also called the Reindeer Age because Cro-Magnon was a great hunter of these animals. In addition to the small stone blades, the Magdalenians used many implements of bone, ivory and stone, (including stone lamps for burning oil) and doubtless also of wood. They buried their dead, as Neanderthal had done before them. In the Magdalenian culture, however, the most amazing achievement was the creation of engravings of animals, then living, in outline on ivory, bone and stone, of rock paintings, and sculptures modeled in clay with such skill that they are recognized as works of high artistic merit of all time. As may be seen in the diorama, Cro-Magnon in southern France decorated the walls of his caves with pictures of the animals he hunted.

We can see that the objects made and used by Cro-Magnon man are much greater in number than at any previous time. The desire of man must have grown in number too, and the means to satisfy these requirements, now the necessities of life, have increased enormously since the time when man first mastered the art of fashioning a tool of stone.

## 5. *Pottery, Navigation and the Bow*

Some time after the beginning of the farming stage in the Near East there lived in western Europe along the Danish shores of the Baltic Sea a people having the Ertebölle way of life. They made pottery vessels, had the dog but no other tame animals, nor any cultivated grain. They had boats, probably dugouts, made by carefully hollowing out logs, in which they went deep sea fishing. From these facts we consider it probable that they were acquainted with more advanced peoples of the farming stage from whom they had learned the new inventions.

Cro-Magnon Man had used the harpoon with a thrower by means of which his weapon could be hurled farther, more accurately, and with greater speed than with the arm alone. The Ertebölle people used the bow and a peculiar type of arrow. Instead of having *pointed* arrowheads that we are familiar with, the striking part of these arrows were *broad chisel-edged* flints. Perhaps these are supposed to cut gashes and make the animals bleed to death quickly. As the bow and arrow were later developed for fighting and hunting it became an extremely effective weapon. However, it is not unlikely that Magdalenian Man with his harpoon and thrower was a more formidable opponent than the Ertebölle bowman.

It is interesting to note that at this time the people of the Near East and the Eygptians were already well along in the farming stage which again shows that all peoples do not arrive at the same level of progress at the same time. It is also seen that certain inventions developed in an advanced stage may be adopted by people in a similar stage before they take over the key inventions. Nevertheless, the fundamental changes brought about by a key invention do not appear in the culture until that invention itself is in full operation.

## 6. *Farmers and Herdsmen*

"It would be great fun," says Billy, "to live in a house over a lake. You could go in swimming anytime you wanted to." I imagine that same lake was a constant source of worry to mothers for just that reason,—their children might take to the water too early. For the safety of all, however, the Swiss Lake Dwellers felt that it was well to have a stretch of water between themselves and possible enemies on shore.

Besides having houses on top of piles or posts the lake dweller had many other useful inventions to make life easier. He was a farmer and tilled the soil to raise wheat, barley and millet. His herds of pigs, sheep, goats, and cows gave him meat and milk, and oxen dragged his plow over the fields. In addition to grain and meat, his fields furnished him with flax and his sheep, wool so his women-folk could spin the fibers into thread, make nets for fishing and weave thread into cloth for clothing. Pottery, and possibly skin bottles and other containers, were utilized for storing grains and liquids.

The earliest lake dwellers painted strange designs on pebbles, some of them like modern letters. They adorned their bodies with red ochre, wore boars' tusks and round pieces of human skulls as necklaces and pendants. Very possibly they buried their dead in dolmens and other stone tombs as did other peoples in the early part of this stage. They had polished as well as chipped stone but did not know the use of metals.

Later lake dwellers knew how to make bronze tools and ornaments. At a still later lake village on Lake Neufchatel, iron was in common use. From the remains on this last site it was not difficult for the archaeologist to discover that it had been captured and burned by the Romans.

## 7. *Merchant Ventures in Bronze*

The domestication of plants and animals and the smelting (reducing native ores to metals) and casting of bronze seems to have developed first in western Asia, probably in the region of the Caucasus mountains. Bronze lends itself to casting better than copper and holds a better edge. In these respects, of course, iron and steel are still better. The usefulness and lasting qualities of metal tools and weapons would be

readily accepted by most men as soon as seen and tested, to take the place of stone and bone implements.

The best bronze is an alloy or mixture of about ninety percent copper with ten percent tin. The resulting metal is far better for tools and weapons than either of the metals that go into its make-up. When Asiatic sources of tin were exhausted or costs became too high, ores were sought farther afield. Mines were later opened in the Iberian (Spanish) peninsula and in what is now Czechoslovakia, necessitating long trips mostly in small boats (as seen in the diorama) to carry ore to the smelters in the near East.

Artisans in bronze, perhaps dissatisfied with crowded conditions in their near eastern home-land and tempted with greater profits where the methods of manufacturing the metal were yet unknown, settled among the ruder peoples nearer the mines. Here they could trade with profit for the ores. Doubtless they brought along some of the comforts of their civilization, like the small Asiatic horse, to their new home among the barbarians.

These backward tribes (due to their simpler background) would be slow to master the difficult processes of transforming the ores into metal and fashioning that into the finished products such as *fibulas* (safety pins and brooches) and sword blades. Quite possibly early bronze workers jealously guarded the secret of their methods for a long time.

## 8. *The Divine Right of Rulers*

When man lived in trees by his lonesome he was not concerned greatly by any consideration for others. He could go and come as he pleased. His contacts with fellow-humans were confined chiefly to the courting periods and to fighting rivals. When man moved into the cave

and reared a family, we have seen that he had to put up with the other members of his household. He probably found this by no means easy. In the third or farming stage, his freedom of action as a villager was still further reduced for he now had to avoid treading on his neighbors' toes if he was to have any peace. Moreover, he had to stay at home to take care of flocks and grain fields.

The settlement of disputes and the prevention of injury to citizens of the village must early have become a concern of the village fathers. Councils of the older people or elders might be the ruling body for the usual situations arising while the General Assembly of all citizens would decide more important issues and act in emergencies. Thus a form of democracy seems to have been the oldest type of government to arise.

As communities grew larger, it became difficult to secure quick agreements for action or perhaps any agreement at all. So the custom arose of the Assembly appointing a single individual to command and direct group action on such occasions, especially in times of trouble with neighboring communities. Later when peaceful intervals were short and war became for long periods the customary state of affairs, this chief-for-the-moment became a permanent commander or king.[15]

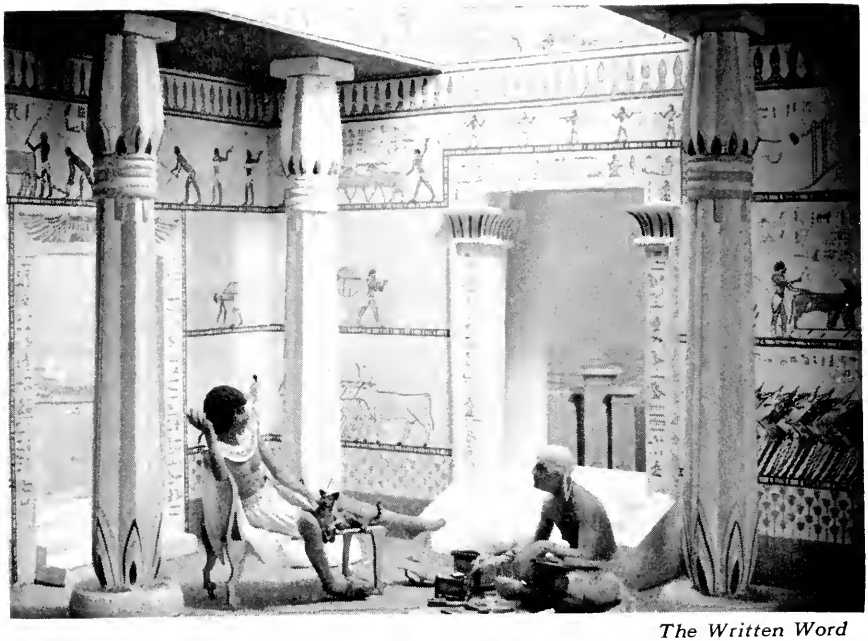
The rulers of village and city in western Asia were the last court of appeal in case of disputes. They found it no simple matter to maintain law and order among their subjects. By now men believed in gods who were interested in the affairs of man. It was a usual condition for a city-state or country in that area to have a particular God as its divine protector.

Some resourceful ruler reasoned that law and order were ordained by the gods and to persuade his people to more readily obey the law, he made out, with the help of the wise men of his community, a code or list of rules of proper conduct and presented these to his people as instructions from the protector-god. In much the same way Moses gave the Ten Commandments to the Israelites. The idea of supernatural sanction and backing of rules became widespread and was carried into Africa and later to Europe.

In the above picture a ruler of New or restored Babylon, seated among the palace ruins of an earlier empire, instructs his son in the laws of the state he will later govern.

## 9. *The Written Word*

Until it became highly desirable to keep complicated records, such as tax assessments and collections or sales credits, man depended on his memory. Sometimes he used pictures or crude drawings to aid him in recalling important events he wished to preserve. It was a "short" step from this to the use of pictures for ideas. Some of these became formalized, that is, each picture was fixed to express the object represented or in some instances, a general idea also. Pictures so used were later simplified to make them easier to write down. The resulting symbols or signs are known as ideographs. Still later arbitrary phonetic signs were included with ideographs giving rise to hieroglyphic writing. The Chinese language still retains ideographs which they literally paint with a brush.



*The Written Word*

Egypt though perhaps not the country where writing was invented is usually the first that comes to our minds when hieroglyphs are mentioned. For the Egyptians not only carved many inscriptions on stone monuments, statues, and painted them on the walls of burial chambers but they wrote papyrus rolls or books on medicine, geometry and surveying, on law and religion, that have been preserved in the dry tombs down to our times. These have been deciphered (read) with the help of the Rosetta Stone, on which was carved the same text in ancient Egyptian and in ancient Greek.

In the diorama, a bored Egyptian Nobleman dictates to his smug-looking scribe, while idly stroking his cat. This animal was first tamed in Egypt. The one in this scene shows his close relationship to the wild cats of the Nile Valley. On the walls of the room we see pictured the owner's flocks and herds. Over the door he boasts in hieroglyphs, "I have extended the boundaries of my estates far beyond those of my father."

## *10. Ships and Foreign Trade*

The Egyptians had boats with sails at an early date and voyaged on the Nile River and on the Red Sea. However, they did not seem to like the idea of great open seas like the Mediterranean and would seldom venture out upon it.

The Cretans were born sailors. They lived on an island to which their ancestors must have come in boats. They were daring seamen and carried on trading for most of the countries bordering the Mediterranean.

*Ships and Foreign Trade*

They seem to have benefitted by adopting many customs and inventions of neighboring nations and welding them into a culture in some aspects strangely resembling our American way of life. They built roads and great buildings with baths, running water, and other sanitary improvements. They provided great public entertainments in which acrobats and bulls took part. Women dressed in jackets and dresses quite modern in appearance.

In this scene we see the merchant prince of Crete looking from the battlements of his palace over the harbor crowded with ships newly home from Egypt, Iberia, Greece, Lebanon, Italy and the Isles of Tin (Britain).

## *11. The Horse and The Sword*

Troya, Illios, or Hissarlik as it is variously called, occupied a commanding position before the entrance to the Straits of the Dardenelles. By virtue of its location it was able to collect toll from ships going through to the Black Sea and Danubian ports. Eleven cities and villages were built in turn on the same ground.

As you remember from reading the stories of the Iliad, the rulers of the Greek cities attacked Troy, possibly to do away with this costly trade restriction (though Homer says it was to avenge Menelaus of Sparta whose wife had been stolen by a prince of Troy). The Trojans

*The Horse and the Sword*

took refuge behind the walls of their well fortified city, issuing forth from time to time to attack the Greeks and to drive them to their ships.

After almost ten years spent in besieging Troy, Achilles, the mightiest of the Greek warriors fell out with Agamemnon, their supreme leader, and refused to fight. In his absence from the battlefield, the Greeks suffered many defeats and once their fleet was in grave danger of destruction. Achilles doubtless looked upon the setbacks with satisfaction; certainly he made no move to aid his friends.

Finally Patroclus, after failing to move his good friend, Achilles, from his anger, borrowed his armor, horses, and chariot and, so outfitted, led the Greeks against the Trojans. Mistaken for Achilles and at first successful everywhere, he finally met Hector, greatest of the enemy warriors and heir to the throne of Troy. In the ensuing combat, Patroclus' good fortune deserted him and he was killed.

Achilles' grief at his friend's death overcame his anger and desiring only to revenge himself on the Trojans for the death of his friend, he rejoined the Grecian Army and helped them capture Troy and burn it. First, however, he had to perform the required funeral rites for Patroclus. The body was burned on a pyre or pile of wood specially built for the occasion. The following morning the bones were collected from the ashes and placed in a golden vase in a building newly erected for the purpose on the plains of Troy.

Following the ceremonies, Achilles was host and judge in a series of funeral games held in honor of the dead hero. In the diorama, we see Achilles (right) preparing to hold the chariot race with prizes for the winners set out near the center of the scene.

## *12. The Determination or Diagnosis of Disease*

The Greeks of the fourth and fifth centuries B.C. were one of the most intellectual peoples the world has ever known. Their achievements in the fields of music, painting, sculpture, poetry, literature, philosophy, medicine, war, and government reached such a high level that the period is spoken of as the Golden Age of Greece. Among the great men of the time should be mentioned: Pericles, statesman and orator, Aristides and Themistocles, statesmen and military leaders, Miltiades and Leonidas, military leaders, Aristotle, philosopher and scientist, Socrates and Plato, philosophers, Aristophanes, comic poet and dramatist, Aeschylus, Euripides, and Sophocles, tragic dramatists, Phidias, sculptor, Thucydides, historian, Demosthenes, orator, and Hippocrates, physician.

Much of Hippocrates' life and accomplishments are lost in the legends or fanciful stories told about him. Nevertheless his writings that have come down to us show beyond doubt that he made careful first-hand observations concerning the nature and functions of the parts of the human body. Both physician and surgeon, he was able to diagnose (or determine) what disease a patient had from his condition and his description of his symptoms (pains, etc.) much as doctors do today.

The above scene is in the courtyard of a fifth century Grecian home in the city of Olynthus. Hippocrates is showing two medical students that the presence of liquid in the lungs means the man has a certain disease known to us today as tuberculosis. At that period boys wishing to become doctors would apprentice themselves to a well-known physician and follow him about to learn how he found out what was wrong with a patient and what he did to cure him.

## *13. Engineering and Public Works*

While Greece was the molder of thought of the western world, in the fields of art, science, philosophy, and literature, Rome, the great conqueror, was the leader in architectural and engineering works and in law.

Rome was a strong and hardy republic for nearly five hundred years. It followed the voting practices used by the Greek city-democracies and improved on their ideas of "representative" government. In other words, the citizens did not get together to make laws because there are too many of them to assemble in one place. Cities were divided into parts or precincts, the inhabitants of which voted for delegates to act for them in the legislature.

Eventually the Roman republic drifted into an imperialist policy of conquest which brought much of Europe, northern Africa, and western Asia under its control. As the population, power and wealth of this vast nation increased, the policies and methods of governing it proved inadequate to handle the tremendous complexity of its growing economic, social and political problems.

A strong man with absolute powers seemed to promise a sure way out of the confusion, so it was a relatively simple matter for an able leader like Julius Caesar to take control, as he did shortly before the birth of Christ. As many of the emperors who followed him were neither able nor public-spirited, the break-up of the Empire was only a matter of time. Even so, such was the hold it had on men's minds, that the Empire continued with more or less of its power and territory for almost five centuries longer.

Rome, as a result of its conquests did much to civilize the barbarians or less advanced tribes of central and western Europe by establishing among them Roman laws, farming methods and engineering structures. For the cities built in the provinces, water was carried from a lake or river by large mains or pipes of stone which were supported on a bridge-like structure or aqueduct where it crossed streams or valleys. In the diorama, the engineer in his inspection of the water system is assisted by the Roman legionary or soldier who points out a leak.

## *14. The Art of Printing*

We have seen how speech developed slowly, possibly before the Age of Farming, into languages capable of expressing most of our thoughts of today. With the coming of herds, wealth, governments and taxation, and cities with large populations, the need for records and calculations grew and finally man invented a means of putting his words on bone, shell, stone or clay tablets and later on paper, by using signs or symbols. Later "scrolls" or books were used to write down methods of conducting important ceremonies and of determining or treating disease. The books produced by Roman authors and during the Middle Ages were made by hand one copy at a time. The making of a number of copies of a book was a tedious, time-consuming task and consequentely editions were small and the books very costly.

In China, as early as 1000 B.C., movable clay type was used to make books simply by mechanically stamping or printing the pages. By repeating the action as many copies as desired of the book were made in a short time with much less labor than by the method of hand copying. In China, however, this method of printing soon disappeared for two reasons, the vast quantity of type required and the abundance of

cheap labor. In order to write a Chinese book thousands of different characters must be used. In China, labor was very cheap, so it was simpler and less expensive to have each page carved out on a wooden block. These could then be used to print any number of copies that were desired in the same manner as with a "box" of movable type.[16]

Printing establishments in the Middle Kingdom (as the Chinese call China) were usually supported by wealthy patrons of noble or royal descent. Strangely to us, the Chinese (as shown in the diorama) printed the page by pressing the paper on the inked type.

## *15. The Rise of Universities*

After the fall of Rome (Western Empire) in 476 A.D. its territories were overrun by the rude tribes of northern and central Europe. The five hundred years that followed this disaster was a period of confusion and disorder, generally known as the Dark Ages. Each barbaric tribe had its own simple laws which applied to their way of living. In the conquered country at first the barbarians had little interest except to loot and wander about seeking new sources of plunder. The citizens of the Roman Empire, who had been accustomed to orderly government and the safety of their persons and property, had no authority to turn to for protection.

Very slowly, order was re-established and a revival of learning or the Renaissance was brought about. This was due, in part, to the leadership of the priests of the Christian Church who interested themselves in the writings of the Greeks and Romans, and in part, by the survival of Roman law in Italian cities and in isolated communities of the fallen empire.

The priests and theologians were the educated class during the Dark Ages. In their endeavors to teach the ignorant masses, they established cathedral and monastery schools for clergy and laymen. Students traveled for long distances to study under some noted teacher. From these groups of students gathered about a famous teacher, the Universities arose, but the development was a long one and each institution had its own peculiar pattern.

Generally a teacher with a reputation drew around him a number of students. His success would be noised abroad and the group would grow in number. Other scholars, attracted by the existing body of students, would "set up chairs" and begin to teach. To protect teachers and students from persecution and unwarranted interference, each school or *studia publica* (public place of study) sought charters of rights and privileges from pope, king and noble. These charters were similar to those issued to merchant and craft guilds of the time and mark the beginnings of the University in western Europe.

## *16. Columbus Sails West to Reach the East*

Why is Columbus known to every school boy? He was *not* the first European to set foot on the American continent. He did not see the mainland until August 1st, 1498, on his third voyage; John Cabot had already reached the North American continent the preceeding year. Vasco de Gama, Prince Henry of Portugal and many another sailor were making names for themselves by important discoveries at the same period.

Let us look into his boyhood and early manhood for the answer. Columbus was the son of a poor Genoese weaver. He was named for St. Christopher, who as every child of the Middle Ages knew, was the patron of travelers. During his youth he helped his brothers card wool and weave it into cloth. When he was eighteen people used to stop on the street to gaze at the tall youth with his shock of red hair. And his schooling? Up to manhood he had none. He had probably sailed around the Gulf of Genoa, along the coast of Italy, and perhaps to Corsica.

When he grew older he went to Spain where he had relatives. Possibly he began to dream now about what he hoped to do later. At any rate, he began to study Spanish, learned how to read and write it well (he seems never to have written in Italian); he perfected himself in geography, in the arts of talking and of sailing ships. As a sailor, he visited ports of the Mediterranean Sea, he voyaged along the coasts of Africa, to England and Iceland. All this time he was mulling over in his mind an idea,—a conviction that almost became an obsession,—he could reach the Orient by sailing westward only twenty-seven hundred miles! For years he tried fruitlessly to get different European rulers to back him and outfit an expedition so he could carry out his plan,—he had no misgivings that he might be unsuccessful. But someone might get there first!

We can imagine him arguing before the Advisory Council in Barcelona that Cathay (China) and Cipango (Japan) lay a short 3000 miles due west of Spain. Actually he was pitting himself, his experience and limited knowledge against the greatest minds of his time, the foremost astronomers, geographers, and mathematicians of Europe. On their part they *knew* from scientific observations and computations that Columbus was wrong and that the distance between Spain and Asia was close to 10,000 miles.[17] The voyage was too great for the vessels of the day,—in spite of his confidence, he could not sail that far without putting into port for fresh water, food and ships' supplies. Nevertheless, the Council was impressed by Columbus' personality and evident sincerity.

After Queen Isabella consented to back the venture and offered her jewels to help (she never actually pawned or sold them), Columbus still had to convince hardheaded sailors and pilots,—not that a ship could sail "back uphill" on a globe,—not that sea monsters were only the stupid imaginings of the ignorant,—none of these, but he did have to reassure them that if they did not strike land within a certain number of days, he would turn back so they could reach Spain before their food and water gave out. But he *knew* that they would make land before it would be necessary to turn back.

Although Columbus was a great sailor, and in a sense, he was a discoverer of America (both Amerindians and Norsemen had touched the continent and colonized it long before his day), his greatness lies not in these. Nor does it rest on the proud titles and awards he received nor upon his settlements in the New World and his government of them.

His grand idea to bring Europe and the old civilization of Asia into closer contact with each other by sailing west, to convert the Indians and Chinese to Christianity and to more enlightened ways of life, and his continued self-training to perfect himself for his task and to make

his reasoning convincing to those who could assist him in getting it started,—his persistence in following out his dreams in the face of rebuffs and disappointment,—these are the factors that make Columbus one of the great characters of history, a man worthy of being remembered through the ages.

*Voltaire Discusses Democracy*

## *17. Rise of Democracy*

Man in the feral (wild) state probably came the closest to being free of any human being. Hunger, the storm or cold, or the rare need for fellowship were almost the only conditions that forced him to bestir himself.

When man began to live with other human beings, he had to give up some of his freedom and think to some degree of the rights and comfort of others. In other words, he had to domesticate or tame himself.

Government in the simplest political sense did not begin until the second or food-producing stage when man began to live in villages. What happened within the family mattered little to *other* families; but an individual injuring a person of another family involved his own family and disturbed the peace of the entire village. So his freedom had to be still further reduced.

Along with the pressure of his fellow villagers on him to live right with them, there grew up certain civic rights. Among these was the privilege and duty to help in making the laws or regulations by which the community was governed, the safety of its members was assured and order was maintained. The early primitive village apparently met

in assembly, similar to a New England town meeting, to discuss matters of interest to all villagers and decide on the action to be taken. Different suggestions of the citizens would be considered and finally one of these would be placed before the meeting to be voted upon. First, those in favor of the idea would be asked to say together yea or yes; next, those against it to say nay or no. Those making the most noise would decide the question. This meant that the majority (more than half) of the assembled villagers had their way, or the majority ruled.

While it was not hard to determine to the satisfaction of everyone in a small village meeting what the majority wanted, in the large cities developing later in this stage, it was quite a different matter.

In emergencies where the very existence of such a community was threatened, quick and reasonable decisions were difficult to obtain. To get immediate action, the assemblage or possibly a council of elders often chose a person, well-known and respected as leader, with absolute authority to command until the danger was over. In the Near East and some other areas where many cities rivalling each other in power, size and wealth sprang up, emergencies became the usual condition. Here the leadership often passed from father to son or nephew, and finally the ruler became a king with unlimited power in peace and war. In such countries, the people lost their rights to make the laws, insure justice being done, and even many of their individual or personal rights.

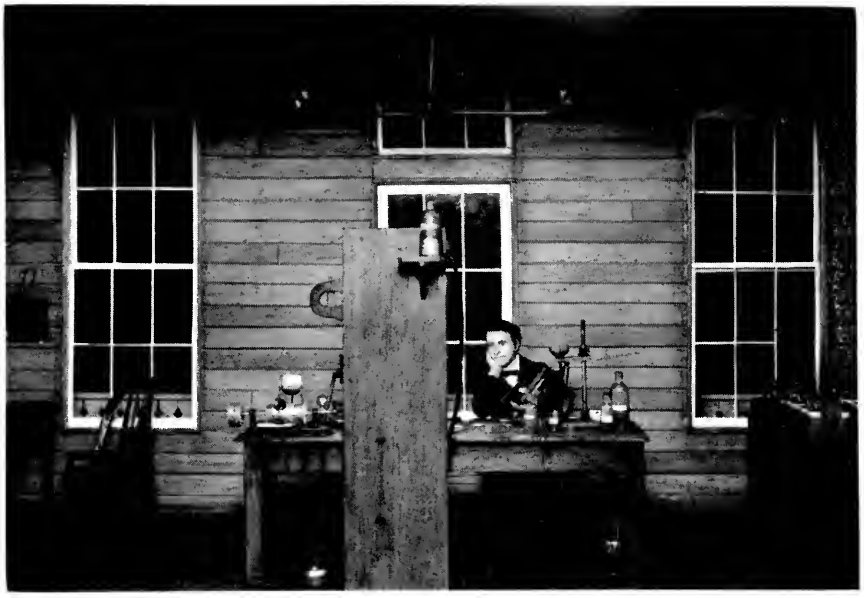
As time went on, the idea of kingship spread over much of the world. Possibly most peoples concerned thought it easier to let one man make decisions for them. Here and there, over long periods of time, as in the ancient Greek city-states, in Switzerland, and among certain of the American Indian tribes and confederations, democracy or representative democratic forms of government arose, flourished for a time and, disappearing, left in man's mind patterns by which men could govern themselves under different conditions.

Late in the seventeenth century a new invention, that is often overlooked, was made. Better said, it was an improvement in an invention of long-standing and one that was to have far-reaching effects on the continuance of existing democracies and the formation of new ones.[18] In 1695, newspapers in England were released from government control and permitted to print the news without first having them officially censored. This was the beginning of the *free press* which by extension today includes telegraph, telephone, cable, news magazines, radio, television and books. Without reliable sources of *impartial* information within the reach of all its citizens, it is doubtful that popular government in a thickly settled state of wide extent could endure.[19]

In 1776 our own United States disturbed the peace of mind of the world's absolute rulers by forming a republic. Undoubtedly the success of the Colonies in breaking away from England had a deep effect on the growing restlessness of the oppressed French masses.

In the 18th century Europe, philosophers were writing about basic human rights which they believed all men everywhere should have, but which were denied them in countries ruled by kings. Among these great thinkers was the Frenchman, Francois Marie Arouet, best known simply as Voltaire. For his writings in behalf of those oppressed by their rulers, he was cast into prison more than once and at one time exiled from

France. Finally in 1778 he returned to Paris, where he was greeted with enthusiasm by everyone but the Royal Court. Although he did not live to see the overthrow of the French Monarchy, he did much to mold eighteenth century thought and hasten the coming of the French Revolution.



*Edison and the Electric Light*

## *18. Edison and Electricity*

In the Boston telegraph office, the boys were crowded around to see the fun. At the instrument sat a green country youth from somewhere in the Middle West. Knowing glances, eager with expected amusement, passed from one to another and whispers, "Yeah, he gets these messages all right but wait 'til New York starts." Each of the listeners had had his chance—except the unkempt boy from the West—to receive from the New York operator, and so fast had he ticked off the words that none had been able to keep up with him. Ah! This is New York. "Click, clickety-click, click....." the instrument rattled off. All other sound and movement stopped. At last the ticking stopped. Someone drew a deep breath. Another stifled a nervous titter. Then over the wire came the curt query: "Well, did you get it?" "Got it." New York again "Who the deuce are you?" Back went the reply, "Tom Edison, shake hands."

Edison, on account of his many inventions and those he stimulated others to make, is the one man in the United States who perhaps typifies more than any other the spirit of the machine age. Among his more important inventions are the phonograph, the stock ticker (to record market quotations), multiplex telegraphy (sending several messages over

one wire at the same time), motion pictures, the alkaline storage battery, the microphone, and the incandescent light. In the picture above, Edison is seen watching his experimental light as it continues to glow through the long night.

Edison was not, however, the discoverer of electricity nor even the first inventor of electric machines. Doubtless many persons had seen the simple effects of man-made electricity before man could write, but apparently Thales, a Greek of Miletus, was the first to record that amber (and certain other substances) when rubbed would attract feathers and straw to it, a property of static electricity.

The advance in understanding of electric energy were few from the time of Thales, ca 600 B.C., until the eighteenth century (after 1700). Among the great discoverers and inventors in the electrical field should be mentioned Galvani and Volta (Voltaic cell and electric battery), Cavendish, Coulomb, Ohm, and Oersted (electromagnetism, Coulomb's Law, Ohm's Law), Hertz and Morconi (Hertzian waves and wireless telegraphy), Sir Humphrey Davy (arc light), Faraday (induction coil and dynamo), Clerk-Maxwell (wave theory of electrical transmission), Ampere (fundamental laws of electricity), Sturgeon (electro-magnet), Lord Kelvin (electrochemistry or the relation of chemical changes to electricity), and our own Benjamin Franklin (kite experiment to show lightning and electricity are the same), S. F. B. Morse (telegraph), Alexander Graham Bell (telephone), Edison and others.

In addition to the purely electrical machines there are, of course, many electrical devices used in connection with machines driven by other kinds of inanimate power, for example in the automobile,—starter, storage battery, ignition system, lights, gasoline gauge, windshield wiper (electric), electric clock, brake and turn lights.

Although the nineteenth and twentieth centuries have been called the "Age of Electricity", they are actually a part of that period of great mechanical achievement that we call the Machine Age. Of these other machines we shall speak briefly in the next section.

## *19. Today and Tomorrow*

Doubtless many other scenes from the history of civilization could be added in their proper time-place in the series. Probably you can think of some you believe are fully as important as any of those shown. Naturally not all significant inventions could be made the subject of dioramas without making the number overly long.

Actually there can be no last act in a series of man's adventures in cultures unless, of course, man himself passes from the stage of existence as did the dinosaurs and mammoths. However, in completing a tale, it is usual for the teller to bring it to some sort of a satisfactory ending.

This the artist has attempted to do in the final diorama by indicating in a dreamlike background the continued development of the steam, diesel, electrical and hydroelectrical, and gas engines used in trains, in aerial transport, in lake and ocean-going vessels, in construction projects

of road and bridge building, in farm machinery. The great city of the future shows us the massing of greater and greater numbers of people in ever smaller land areas. From all of this it is not hard to picture the difficulties of conducting the business of government and the administration of justice with great masses of people in an increasingly complex world of machines.

As an artist signs his oil painting or water color, or the sculptor carves his name or initials on a statue, so Mr. Frost has left his unique signature—a portrait figure of himself in wax as the operator in the conning tower of the airport.

## *Conclusion*

In the long ago before Europeans reached Illinois, western culture or ways of living had developed in Europe. A somewhat simpler type of this culture was brought to the Americas and Illinois with the explorers and settlers from the Old World. Here new inventions, that enriched this inheritance, were added as time went on.

Brought to our western country were knives, axes and other specialized tools of steel and customs which had in Europe been added to the tools, weapons, and culture of the earliest tool-making men. The dogs and the herds of cattle that replaced the buffalo and deer on the Illinois prairie were descendants of the dogs and cattle that were kept by the men of Ertebölle and the Lake Dwellings; to the tradition of the farmer, our own Illinois has contributed the steel moldboard plow, the reaper, binder and the combine. The dome of our state capitol, our bridges and engineering achievements had their roots in structures of Roman and Babylonian builders, the religion of most people of the United States developed in western Asia, while records, taxes, surveying, writing had their beginnings in the same region and in Egypt. The earliest democracy was first practiced in the farming villages of western Asia, adopted by the Greek City States that added voting by ballot, and further developed by the more populous Roman Republic through the principle of popular rule by representation and adapted now to our own state and national governments.

Basically our own way of living has come from Europe and western Asia. These traits or habits of life we have adopted more or less successfully to our needs and the conditions under which we live and to further this end have added inventions to our own making.

At different periods of the world's cultural existence different races, different nations or cultural groups have assumed the lead in maintaining and gradually changing the ways of life. One of the nations in the role of leader today is the United States of America. May it be the endeavor of all of us in this great country of ours, to choose and influence our politicians and statesmen so it may lead wisely and well.

# NOTES

| NOTE | PAGE | |
|---|---|---|
| 1 | 5 | Food-draft animals refer to mammals like the cow and the ox that not only served as food but also drew the plow and the cart. |
| 2 | 5 | The term *stage* as used here means the cultural state introduced by a key invention, not a time period. Different peoples go from one stage to another at different times and pass through them at different rates of speed and in different ways. China's progress in the machine age has been relatively slow compared with Japan for example. Great Britain and the United States have been highly industrialized for almost a century. It is possible that another invention might have led man to domesticate himself, but it appears that only one did, the invention of conchoidally chipping flint. The exact type of tool that resulted is unimportant. In fact different tool types may have appeared first in different localities.<br><br>It is also possible that man might have developed a succeeding stage of culture by a key invention other than the domestication of plants and animals but apparently he did not. In a similar way he seems to have developed through the use of inanimate power into the present stage of culture in America and Europe. |
| 3 | 5 | All dates given, unless otherwise stated apply only to those regions in which the inventions first appeared. The limits of the first great time period are suggestive only and may be in error as much as a hundred thousand years or more either way. They do serve to indicate how long man was in developing his culture and way of life, and how the intervals between key inventions grew shorter as they followed each other. No dates in this paper should be considered exact, but only as accurate as the time can be estimated by archaeological and geological methods or from the earliest written sources available. |
| 4 | 7 | Braidwood, Childe, and others have called this the *food collecting stage*. While it is true that man had a collecting economy in this period, so he did in the wild or feral state, and in that was not different from other animals. The first step is the *key invention*, the discovery of the mechanical principle that stimulates his brain and leads him to consciously control his hand and coordinate it with his eye, and eventually to the vision and the technological skill necessary to make a useful, specialized weapon or tool type and to do it again and again. This invention finally brings man to the point of living in the family group,—in brief, to tame himself. |
| 5 | 7 | In other words, man stopped making nests and platforms in trees and began to live on the ground night and day. He had long since accustomed himself to standing on two feet and to traveling on the ground during the day. |
| 6 | 7 | During this period man doubtless used caves where they were available, but lacking them probably used windbreaks of branches in the open or lean-tos against rock shelters. |
| 7 | 8 | It is generally thought that the dog was the first animal to be domesticated and that at the start he attached himself to man by hanging about the camp, was put up with as a scavenger, and later admitted into the household. This may have given man the idea of raising other young animals in captivity. |

| NOTE | PAGE | |
|---|---|---|
| 8 | 9 | It has been suggested that the term, new customs, be used here. "Customs" have been retained because the relationships of the members of a family to each other in the self-domestication stage must have been (it seems to me) in the nature of family habits changing with each new household head. Even though certain habits grew up where families lived together briefly in this stage and had in them the seeds of custom, they were probably extremely variable and short-lived. The rules within a family today are scarcely legal except as imposed on the group from a section of society outside the unit itself. In the self-domestication stage, the habitual actions and the relationships between members of the family were not customs in the sense that were enforceable by social sanctions or pressure. |
| 9 | 11 | The first written account in the Western World of a waterwheel is found in the writings of Philo of Byzantium, a well-known technician of the 3d century before Christ. Waterwheels were used at that time as "scoopwheels", or to run a chain of buckets for irrigation, or to animate moving figures.<br>The first use of a waterwheel to drive a grist mill is not known. Strabo, the Greek geographer, writes that Mithridates VI king of Pontus (in Asia Minor) had a watermill for grinding grain. Vitruvius, Roman architect and engineer, in 24 B.C. describes a mill, powered by an undershot vertical waterwheel, connected by "peg and trundle" gears to the millstones.<br>Antipater, the poet, about 60 A.D., speaks of watermills. Ansonius in the fourth century who traveled along the Moselle and its tributaries in Germany, tells of numerous watermills sawing stone and making a tremendous din.<br>The first mill in Rome was built at the foot of Janiculum hill and was provided with power from a water system from high up among the hills. (Feldhaus, F. M. *Ruhmesblatter der Technik von den Urerfindungen bis zur Gegenwart* Vol. I, pp 67-68)<br>According to Samuel Webber, ("Ancient and Modern Waterwheels" in *Engineering Magazine* for June 1891, Vol. I, No. 3, pp. 324 to 331), the horizontal or "flutter wheel" was developed early in Southeast Asia. Its shaft connected directly with the millstones, that is, without gears. Feldhaus gives the date of its appearance in Europe as about 1000 A.D.<br>Windmills were known to the Persians by 900 A.D. and to the Arabs perhaps a little later. The invention seems to have been brought back to western Europe by the Crusaders some time before 1390. |
| 10 | 11 | It may be objected that this stage started only in the seventeen hundreds with the introduction of the *fuel-driven* machinery which in a short time "gave rise to the *burst* or revolution in population, growth of cities, tremendous need for social and political adjustments, etc." Starting this stage with the steam-engine would by-pass the *opening* phase of the invention,—the shift from animate to inanimate power, which during the initial period was perfected so when new energy sources were discovered, it was a relatively simple matter to harness the new engines to the old machines. Industrialization began with water-driven spinning and weaving mills; the invention of the steam engine only speeded up and intensified the process. Electricity, the gas and diesel engines have furthered the intensification and it is conceivable the atomic fission may continue to increase it. No such intensification was possible, or at least none developed, with the animal driven machines of the food-production stage. Therefore, it is my feeling that the water-driven mill with its gears was the first of the inanimate power machines, that it began industrialization and so was an important early part of the machine age. The |

water turbine or the windmill or even the steam-engine might equally well have done this, but they did not.

11 15 For many years, anthropologists considered that chipped tools made from the core were invented earlier than flake tools. At present some consider the use of modified flakes as old as core tools. The evidence is by no means clear. It would appear that early man's first use for tools would be for crushing or battering purposes for which weight would be required and that the need for refining flakes would appear only a long time after the first core-type tool had come into use. Logically, it seems to me that man's needs would lead him to use first a relatively large unmodified stone which could be held readily in the hand. The next step would be to improve this by breaking off portions to give an effective edge or point. This improvement would be followed by the earning of a predictable flaking technique for the purpose of improving the core-type tool.

Whether or not the first type of tool was fist axe, chopper, or flake implement doesn't really matter for our purposes. The important factor is that man discovered a method of knocking flakes off certain rocks and then proceeded to develop a tool that became a type or pattern for subsequent production. To perfect this method so he could produce an Abbevillian handax or an Asiatic chopper may have taken hundreds of years, possibly thousands.

12 15 The cultures or *ways of living* of ancient man are named from the specialized stone tools found on their old dwelling places. The chief cultures of very early times in *western Europe* in order of their age are as follows (earliest at the top):

| *Core-biface* | *Flake* |
|---|---|
| Abbevillian (or Chellean) | Clactonian |
| Acheulian | Tayacian |
| Micoquian | Levalloisian |
| | Mousterian |

The early chopper tools of eastern and southeastern Asia are presumably as old as the first European tool types. See note 11.

13 16 The physical types of man may be divided into three major groups. 1) Protoanthropic (first man) 2) Palaeanthropic (old man) and 3) Neanthropic (new man). "First" men includes Java and Pekin men; "old" includes Neanderthal; and "new", Cro-Magnon, Grimaldi man, and the modern races of which the most numerous are Caucasoid, the Negroid, and the Mongoloid. It will be noticed that human physical types (for example, Neanderthal, Cro-Magnon, etc.) have names differing from that of the culture they practice. This is because men of the same physical type or race may have different ways of life, and men of different races may have the same culture.

14 16 Three techniques or methods of producing the chief flint implement types noted in this paper are: 1) the core technique where the main rock mass is used after it is shaped by knocking off flakes by a controlled technique, 2) the flake struck from the core is further fashioned into a tool by *pressing* off small flakes with a punch to form cutting edges, stem, etc. and 3) the blade method where parallel-sided flakes are struck off from a specially prepared core by a special technique. These blade tools are further modified by pressure flaking or retouching. The flaking of rocks other than the flints could not be readily controlled and they were rarely used.

15 21 These leaders and kings were of two types, the warrior-king and the priest-king, which may be explained somewhat as follows:

| NOTE | PAGE | |
|---|---|---|
| | | If the emergency was danger of attack by a warlike neighboring city that might be overcome or beaten off by an army of soldiers, a warrior would be chosen as leader but if the crisis were an earthquake, a plague or a prolonged drought (rainless period), the priest-leader would be selected. |
| 16 | 28 | Nearly five hundred years after the invention of movable type, Gutenberg reinvented the device. Possibly he got the idea from seeing the printed paper money made by Genghis Khan to pay his troops. |
| 17 | 30 | Contrary to general impression, the educated man of the 15th century was well aware that the world was a sphere. Washington Irving's dramatic story doubtless did much to establish the myth of Columbus' ingenious efforts to convince the supposedly stupid savants that "the world was round". |
| 18 | 32 | Newspapers probably developed from the idea of the news releases or bulletins issued by officials of the ancient government of Rome to inform the citizens about sport and spectacular events as well as the results of battles, elections, and other news vital to the state and its people. The *Frankfurter Journal* published in Germany in 1615 seems to have been the first true newspaper, a weekly. It was followed in England in 1622 by the London *Weekly Newes*. America's first daily newspaper was founded in Philadelphia in 1774. News may have been published before Roman times as it is quite probable that criers were employed to inform the people of happenings of great importance to rulers and communities. Before 1695, however, the news was in the main colored by the bias of the officials censoring or issuing the releases or "in the public interest". |
| 19 | 32 | By *impartial* is meant uncolored information, the presentation of both sides of issues, and no items withheld that could reasonably be considered news. The reader is thus permitted to form his own decision of what is right. Government censored news, on the other hand, is apt to give only that "that the people should know", omitting what might seem to be disadvantageous to the "government" or persons in power. |

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